



(19)

Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

EP 0 874 283 A3

(12)

EUROPEAN PATENT APPLICATION

(88) Date of publication A3:
19.01.2000 Bulletin 2000/03

(51) Int. Cl.⁷: G03F 7/20

(43) Date of publication A2:
28.10.1998 Bulletin 1998/44

(21) Application number: 98107355.4

(22) Date of filing: 22.04.1998

(84) Designated Contracting States:
AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU
MC NL PT SE

Designated Extension States:

Designated Exemptions

(30) Priority: 23.04.1997 JP 10648797
28.05.1997 JP 15585597
28.05.1997 JP 15585697

(71) Applicant: **NIKON CORPORATION**
Tokyo (JP)

(72) Inventors:

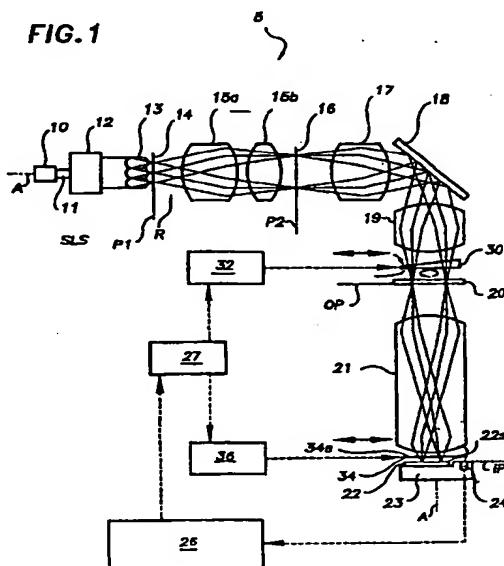
• Mori, Takashi,
c/o Nikon Corporation
2-3 Marunouchi 3-chome Chiyoda-ku, Tokyo
(JP)

- **Takahashi, Tetsuo,**
c/o Nikon Corporation
2-3 Marunouchi 3-chome Chiyoda-ku, Tokyo
(JP)
- **Nakamura, Hiroshi,**
c/o Nikon Corporation
2-3 Marunouchi 3-chome Chiyoda-ku, Tokyo
(JP)
- **Kudo, Yuji,**
c/o Nikon Corporation
2-3 Marunouchi 3-chome Chiyoda-ku, Tokyo
(JP)

(74) Representative:
Viering, Jentschura & Partner
Postfach 22 14 43
80504 München (DE)

(54) Optical exposure apparatus and photo-cleaning method

(57) Optical exposure apparatus (5) and methods of using same, for patterning a workpiece and photo-cleaning the optical components in the apparatus, which can be contaminated by moisture and organic compounds in the atmosphere. The apparatus comprises an illumination optical system (10-19) having a light source (10) and one or more optical components, and a projection lens (21) having an object plane (OP) and an image plane (IP) and one or more optical components. The optical exposure apparatus (5) includes an exposure optical path or an exposure light beam through a predetermined space in the optical exposure system. An optical path deflection member for deflecting light is introduced into the exposure optical path so as to create a second optical path that differs from the exposure optical path. Also, a method for photo-cleaning the aforementioned optical components, including the steps of forming an exposure optical path and then changing this path to create a second optical path that differs from the exposure optical path.





EUROPEAN SEARCH REPORT

Application Number
EP 98 10 7355

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
|--|---|---|--|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | |
| X | EP 0 564 264 A (CANON KK) 6 October 1993 (1993-10-06) * column 5, line 27 - column 6, line 37 * * column 13, line 1 - line 35 * | 1-3,5, 29,53,54 | G03F7/20 |
| Y | * figures 1,17 * | 8 | |
| A | --- | 6,11, 13-15 | |
| X | EP 0 766 144 A (CANON KK) 2 April 1997 (1997-04-02) * column 4, line 17 - column 6, line 49 * * figures 1-3 * | 55,56 | |
| Y | --- | 8,24, 30-35,38 | |
| X | US 4 688 932 A (SUZUKI AKIYOSHI) 25 August 1987 (1987-08-25) * column 3, line 20 - column 4, line 28 * * figures 1,4 * | 3,4,29, 53,54 | |
| A | --- | 6,11, 13-15 | |
| X | US 4 023 126 A (SCHLAFER JOHN) 10 May 1977 (1977-05-10) * column 3, line 7 - column 4, line 27 * * column 5, line 22 - line 42 * * figure 1 * | 16-18 | G03F |
| X | US 5 159 483 A (WATANABE TOSHIYUKI ET AL) 27 October 1992 (1992-10-27) * abstract; figures * * column 9, line 49 - line 51 * | 16-18 | |
| A | US 5 153 773 A (IMAI SHUNZO ET AL) 6 October 1992 (1992-10-06) * column 2, line 65 - column 3, line 17 * * figure 1 * | 16-18 | |
| | --- | -/- | |
| The present search report has been drawn up for all claims | | | |
| Place of search | Date of completion of the search | Examiner | |
| THE HAGUE | 25 November 1999 | HERYET, C | |
| CATEGORY OF CITED DOCUMENTS | | T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document | |
| X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document | | | |



European Patent
Office

EUROPEAN SEARCH REPORT

Application Number

EP 98 10 7355

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | | | | | | | |
|--|---|--|--|-----------------|----------------------------------|----------|-----------|------------------|-----------|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) | | | | | | |
| X | US 5 383 000 A (MICHALOSKI PAUL F ET AL) 17 January 1995 (1995-01-17) * column 3, line 3 - column 4, line 22 * * column 1, line 11 - line 26 * * figure 2 * | 19 | | | | | | | |
| Y | --- | 24,38 | | | | | | | |
| X | PATENT ABSTRACTS OF JAPAN vol. 014, no. 028 (E-875), 19 January 1990 (1990-01-19) -& JP 01 265513 A (NEC CORP), 23 October 1989 (1989-10-23) | 27,28, 36,37, 40,43,48 | | | | | | | |
| Y | * abstract; figures * | 30-35 | | | | | | | |
| A | --- | 17 | | | | | | | |
| X | PATENT ABSTRACTS OF JAPAN vol. 018, no. 324 (E-1564), 20 June 1994 (1994-06-20) -& JP 06 077107 A (NEC YAMAGATA LTD), 18 March 1994 (1994-03-18) * abstract; figures * | 55,56 | TECHNICAL FIELDS SEARCHED (Int.Cl.6) | | | | | | |
| X | US 4 961 001 A (LIEGEL JUERGEN ET AL) 2 October 1990 (1990-10-02) * abstract; figure 1 * | 55 | | | | | | | |
| <p>The present search report has been drawn up for all claims</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 33%;">Place of search</td> <td style="width: 33%;">Date of completion of the search</td> <td style="width: 33%;">Examiner</td> </tr> <tr> <td>THE HAGUE</td> <td>25 November 1999</td> <td>HERYET, C</td> </tr> </table> | | | | Place of search | Date of completion of the search | Examiner | THE HAGUE | 25 November 1999 | HERYET, C |
| Place of search | Date of completion of the search | Examiner | | | | | | | |
| THE HAGUE | 25 November 1999 | HERYET, C | | | | | | | |
| CATEGORY OF CITED DOCUMENTS | | T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document | | | | | | | |
| X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document | | | | | | | | | |



CLAIMS INCURRING FEES

The present European patent application comprised at the time of filing more than ten claims.

Only part of the claims have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims and for those claims for which claims fees have been paid, namely claim(s):

No claims fees have been paid within the prescribed time limit. The present European search report has been drawn up for the first ten claims.

LACK OF UNITY OF INVENTION

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

see sheet B

All further search fees have been paid within the fixed time limit. The present European search report has been drawn up for all claims.

As all searchable claims could be searched without effort justifying an additional fee, the Search Division did not invite payment of any additional fee.

Only part of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the inventions in respect of which search fees have been paid, namely claims:

None of the further search fees have been paid within the fixed time limit. The present European search report has been drawn up for those parts of the European patent application which relate to the invention first mentioned in the claims, namely claims:

European Patent
OfficeLACK OF UNITY OF INVENTION
SHEET BApplication Number
EP 98 10 7355

The Search Division considers that the present European patent application does not comply with the requirements of unity of invention and relates to several inventions or groups of inventions, namely:

1. Claims: 1-7, 9-15, 29, 53, 54

Deflection of exposure optical path and prevention of wafer exposure.

2. Claim : 8

Deflection of exposure optical path and light measurement on wafer stage.

3. Claims: 16-18

Illumination system with optional scanning of exposure path.

4. Claims: 19-28

Enlargement of exposure beam.

5. Claims: 30-52, 55, 56

Compensation for change in performance (reflectance or transmittance) of an optical element.

ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.

EP 98 10 7355

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report.
The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

25-11-1999

| Patent document cited in search report | Publication date | Patent family member(s) | | Publication date |
|---|---------------------|---|--|--|
| EP 0564264 A | 06-10-1993 | JP 5283317 A AT 185429 T DE 69326630 D US 5345292 A US 5726740 A | | 29-10-1993 15-10-1999 11-11-1999 06-09-1994 10-03-1998 |
| EP 0766144 A | 02-04-1997 | JP 9096908 A JP 9115802 A EP 0957401 A US 5892573 A | | 08-04-1997 02-05-1997 17-11-1999 06-04-1999 |
| US 4688932 A | 25-08-1987 | JP 1803656 C JP 5013369 B JP 61184829 A JP 1833571 C JP 5048613 B JP 61232615 A JP 1833572 C JP 5048611 B JP 61232616 A | | 26-11-1993 22-02-1993 18-08-1986 29-03-1994 22-07-1993 16-10-1986 29-03-1994 22-07-1993 16-10-1986 |
| US 4023126 A | 10-05-1977 | NONE | | |
| US 5159483 A | 27-10-1992 | JP 2586662 B JP 3179723 A KR 9400496 B | | 05-03-1997 05-08-1991 21-01-1994 |
| US 5153773 A | 06-10-1992 | JP 3215930 A JP 2765162 B JP 3252122 A JP 2770984 B JP 3011614 A US 5463497 A | | 20-09-1991 11-06-1998 11-11-1991 02-07-1998 18-01-1991 31-10-1995 |
| US 5383000 A | 17-01-1995 | NONE | | |
| JP 01265513 A | 23-10-1989 | NONE | | |
| JP 06077107 A | 18-03-1994 | JP 2856608 B | | 10-02-1999 |
| US 4961001 A | 02-10-1990 | DE 3733823 A FR 2621711 A JP 1123238 A | | 20-04-1989 14-04-1989 16-05-1989 |